

What is claimed is:

1. A transformed cell in which a polynucleotide having a nucleotide sequence encoding an amino acid sequence of an osmosensing histidine kinase having no transmembrane region is introduced in a functional form into a cell deficient in at least one hybrid-sensor kinase.

2. The transformed cell according to claim 1, the polynucleotide having a nucleotide sequence encoding an amino acid sequence of an osmosensing histidine kinase having no transmembrane region is a polynucleotide complementing the deficiency in hybrid-sensor kinase in the cell deficient in at least one hybrid-sensor kinase in which the polynucleotide is introduced.

3. The transformed cell according to claim 1, wherein the cell is a microorganism.

4. The transformed cell according to claim 3, wherein the microorganism is budding yeast.

5. The transformed cell according to claim 1, wherein the osmosensing histidine kinase having no transmembrane region is an osmosensing histidine kinase having no transmembrane region and having a mutation which confers resistance to any of a

dicarboxyimide antifungal compound , an aromatic hydrocarbon antifungal compound and a phenylpyrrole antifungal compound to the cell.

6. The transformed cell according to claim 5, wherein the osmosensing histidine kinase having no transmembrane region is a histidine kinase having the amino acid sequence represented by SEQ ID NO: 13.

7. The transformed cell according to claim 1, wherein the osmosensing histidine kinase having no transmembrane region is an osmosensing histidine kinase which is derived from a plant-pathogenic filamentous fungus and has no transmembrane region.

8. The transformed cell according to claim 1, wherein the osmosensing histidine kinase having no transmembrane region is an osmosensing histidine kinase which is derived from *Botryotinia fuckeliana*, *Magnaporthe grisea*, *Fusarium oxysporum*, *Mycosphaella tritici*, *Thanatephorus cucumeris* or *Phytophthora infestans*, and has no transmembrane region.

9. The transformed cell according to claim 1, wherein the osmosensing histidine kinase having no transmembrane region is an osmosensing histidine kinase having no transmembrane region

which has an amino acid sequence represented by SEQ ID NO: 1, SEQ ID NO: 16, SEQ ID NO: 41, SEQ ID NO: 55, SEQ ID NO: 68 or SEQ ID NO: 90.

10. The transformed cell according to claim 1, wherein the nucleotide sequence encoding an amino acid sequence of the osmosensing histidine kinase having no transmembrane region is a nucleotide sequence represented by SEQ ID NO: 2, SEQ ID NO: 17, SEQ ID NO: 42, SEQ ID NO: 56 or SEQ ID NO: 69.

11. A method of assaying the antifungal activity of a substance, which comprises:

a first step of culturing the transformed cell as defined in claim 1 in the presence of a test substance;

a second step of measuring an amount of intracellular signal transduction from the osmosensing histidine kinase having no transmembrane region expressed in the transformed cell cultured in the first step or an index value having the correlation therewith; and

a third step of assessing the antifungal activity of the test substance based on a difference between an amount of intracellular signal transduction or an index value having the correlation therewith measured in the second step and a control.

12. The method of assaying according to claim 11, wherein

the amount of intracellular signal transduction from the osmosensing histidine kinase having no transmembrane region or the index value having the correlation therewith is an amount of growth of the transformed cell.

13. A method of searching an antifungal compound, which comprises selecting an antifungal compound based on the antifungal activity assessed in the assaying method as defined in claim 11.

14. An antifungal compound selected by the searching method as defined in claim 13.

15. An osmosensing histidine kinase having no transmembrane region, wherein the kinase is derived from a plant-pathogenic filamentous fungus.

16. An osmosensing histidine kinase having no transmembrane region, which has an amino acid sequence selected from the group consisting of:

(a) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which has an amino acid sequence homology of 95% or more to the amino acid sequence represented by any of SEQ ID NOs: 41, 55 and 68;

(b) an amino acid sequence of an osmosensing histidine kinase

having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Fusarium oxysporum*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 52 and an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 53 as primers;

(c) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Mycosphaarella tritici*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 64 and an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 65 as primers;

(d) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Thanapethorus cucumeris*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 85 and an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 86 as primers;

(e) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is derived from *Phytophthora infestans* and has the amino acid sequence represented by SEQ ID NO: 90;

(f) the amino acid sequence represented by SEQ ID NO: 41;

- (g) the amino acid sequence represented by SEQ ID NO: 55; and
- (h) the amino acid sequence represented by SEQ ID NO: 68.

17. An osmosensing histidine kinase having no transmembrane region, which has an amino acid sequence represented by SEQ ID NO: 41, SEQ ID NO: 55 or SEQ ID NO: 68.

18. A polynucleotide having a nucleotide sequence encoding an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, wherein the kinase is derived from a plant-pathogenic filamentous fungus.

19. A polynucleotide having a nucleotide sequence encoding an amino acid sequence selected from the group consisting of:

- (a) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which has an amino acid sequence homology of 95% or more to the amino acid sequence represented by any of SEQ ID NOs: 41, 55 and 68;

- (b) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Fusarium oxysporum*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 52 and an oligonucleotide having the nucleotide sequence represented

by SEQ ID NO: 53 as primers;

(c) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Mycosphaerella tritici*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 64 and an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 65 as primers;

(d) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is encoded by a DNA amplified by a polymerase chain reaction using a *Thanapethorus cucumeris*-derived cDNA as a template and using an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 85 and an oligonucleotide having the nucleotide sequence represented by SEQ ID NO: 86 as primers;

(e) an amino acid sequence of an osmosensing histidine kinase having no transmembrane region, which is derived from *Phytophthora infestans* and has the amino acid sequence represented by SEQ ID NO: 90;

(f) the amino acid sequence represented by SEQ ID NO: 41;

(g) the amino acid sequence represented by SEQ ID NO: 55; and

(h) the amino acid sequence represented by SEQ ID NO: 68.

20. A polynucleotide having a nucleotide sequence represented by SEQ ID NO: 42, SEQ ID NO: 56 or SEQ ID NO: 69.

21. A method of obtaining a polynucleotide having a nucleotide sequence encoding an amino acid sequence of osmosensing histidine kinase which is derived from a plant-pathogenic filamentous fungus and has no transmembrane region, which comprises a step of amplifying a desired polynucleotide by Polymerase Chain Reaction using an oligonucleotide having a nucleotide sequence represented by any of SEQ ID NOs: 30 to 40, 52, 53, 64, 65, 85 and 86 as primers, and a step of recovering the amplified desired polynucleotide.

22. An oligonucleotide which comprises a nucleotide sequence represented by any of SEQ ID NOs: 30 to 40, 52, 53, 64, 65, 85 and 86.